

=> s (0.01-2)/Li and (1-2)/Fe and 1/P and 4/O  
96359 (0.01-2)/LI  
719933 (1-2)/FE  
873620 1/P  
3405342 4/O  
L1 404 (0.01-2)/LI AND (1-2)/FE AND 1/P AND 4/O

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COST IN U.S. DOLLARS

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FILE COVERS 1907 - 16 Aug 2004 VOL 141 ISS 8  
FILE LAST UPDATED: 15 Aug 2004 (20040815/ED)

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> s l1  
L2 532 L1  
  
=> s l2 and battery  
107670 BATTERY  
L3 274 L2 AND BATTERY  
  
=> s l2 and (battery or cell)  
107670 BATTERY  
1807508 CELL  
L4 304 L2 AND (BATTERY OR CELL)  
  
=> s l4 and (particle (w) (size or diameter))  
613615 PARTICLE  
863245 SIZE  
20141 DIAMETER  
204099 PARTICLE (W) (SIZE OR DIAMETER)  
L5 24 L4 AND (PARTICLE (W) (SIZE OR DIAMETER))

=> d l5 1-24 ibib kwic

L5 ANSWER 1 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2004:433948 CAPLUS

DOCUMENT NUMBER: 140:426125

TITLE: Coating of substrates with active material, binder,  
and thickener for fabrication of **battery**  
electrodes

INVENTOR(S): Zaghib, Karim; Armand, Michel; Guerfi, Abdelbast;  
Perrier, Michel; Dupuis, Elisabeth; Charest, Patrick

PATENT ASSIGNEE(S): Hydro-Quebec, Can.  
 SOURCE: PCT Int. Appl., 37 pp.  
 CODEN: PIXXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: French  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2004045007	A2	20040527	WO 2003-CA1739	20031113
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD RW: BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				

PRIORITY APPLN. INFO.: CA 2002-2411695 A 20021113

TI Coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes

AB An electrode for an electrochem. **cell** (especially a **battery**) is prepared by coating at least partially the electrode with a film obtained by spreading and drying of an aqueous solution on the electrode support, in which

the aqueous solution contains at least an active material, a water-soluble binder, and a water-soluble thickener. Suitable active materials are selected from finely divided (**particle size** 10-50  $\mu$ ) metal oxides (e.g., LiMn2O4, LiCoO2, LiFePO4, LiNiO2, Li4Ti5O12, etc.), ceramics, carbon (including carbon fibers, synthetic graphite, and natural graphite), metals (e.g., Ag, Sn, and Cu), and semiconductors (especially Si). Suitable thickeners include natural and modified celluloses (e.g., CM-cellulose and hydroxymethyl cellulose); suitable binders include natural and synthetic rubber. Both anodes and cathodes can be prepared by this method. The method for electrode fabrication is especially useful for construction of secondary lithium batteries with nonaq. electrolytes and polymeric separators.

ST **battery** electrode coating carbon encapsulation; thickener binder  
**battery** electrode coating

IT Ceramics  
 Semiconductor materials  
 (**battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT Carbon fibers, uses  
 Coke  
 Metals, uses  
 Oxides (inorganic), uses  
 RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)  
 (**battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT EPDM rubber  
 Fluoropolymers, uses  
 Polyesters, uses  
 Polyoxyalkylenes, uses  
 RL: NUU (Other use, unclassified); USES (Uses)  
 (**battery** separators; coating of substrates with active

material, binder, and thickener for fabrication of **battery** electrodes)

IT Acrylic rubber  
Epichlorohydrin rubber  
Natural rubber, uses  
Nitrile rubber, uses  
Styrene-butadiene rubber, uses  
Synthetic rubber, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(binder, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT **Battery** anodes  
**Battery** cathodes  
**Battery** electrodes  
Coating materials  
(coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT Nitrile rubber, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(hydrogenated, binder, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT Secondary batteries  
(lithium batteries; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT **Battery** electrolytes  
(nonaq.; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT Secondary **battery** separators  
(polymeric; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT Polysaccharides, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(thickener, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT Tin alloy, base  
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)  
(**battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 9004-32-4, Carboxymethyl cellulose  
RL: NUU (Other use, unclassified); USES (Uses)  
(Cellogen, thickener, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 7440-21-3, Silicon, uses 7440-22-4, Silver, uses 7440-31-5, Tin, uses 7440-44-0, Carbon, uses 7440-50-8, Copper, uses 7782-42-5, Graphite, uses 12031-65-1, Lithium nickel oxide (LiNiO<sub>2</sub>) 12031-95-7, Lithium titanium oxide (Li<sub>4</sub>Ti<sub>5</sub>O<sub>12</sub>) 12036-22-5, Tungsten oxide (WO<sub>2</sub>) 12057-17-9, Lithium manganese oxide (LiMn<sub>2</sub>O<sub>4</sub>) 12190-79-3, Cobalt lithium oxide (CoLiO<sub>2</sub>) 15365-14-7, Iron lithium phosphate (FeLiPO<sub>4</sub>) 128975-24-6, Lithium manganese nickel oxide (LiMn<sub>0.5</sub>Ni<sub>0.5</sub>O<sub>2</sub>)  
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)  
(**battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 9002-84-0, Poly(tetrafluoroethene) 9002-88-4, Polyethylene 9003-07-0, Polypropylene 9011-14-7, Poly(methyl methacrylate) 9011-17-0 24937-79-9, Poly(vinylidene fluoride) 25034-77-9, Ethylene-propylene-5-methylene-2-norbornene copolymer 25322-68-3, Polyethylene oxide

25322-69-4, Polypropylene oxide

RL: NUU (Other use, unclassified); USES (Uses)

(**battery** separators; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 9003-18-3

RL: NUU (Other use, unclassified); USES (Uses)

(nitrile rubber, binder, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 9003-18-3

RL: NUU (Other use, unclassified); USES (Uses)

(nitrile rubber, hydrogenated, binder, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 96-48-0,  $\gamma$ -Butyrolactone 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate 2832-49-7, N,N,N',N'-Tetraethylsulfamide 14283-07-9, Lithium tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate 90076-65-6, LiTFSI 171611-11-3 244761-29-3, Lithium bis(oxalato)borate

RL: NUU (Other use, unclassified); USES (Uses)

(secondary **battery** nonaq. electrolytes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 9003-55-8

RL: NUU (Other use, unclassified); USES (Uses)

(styrene-butadiene rubber, binder, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 7429-90-5, Aluminum, uses 12597-68-1, Stainless steel, uses

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)

(substrate, for **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

IT 9004-34-6, Cellulose, uses 37353-59-6, Hydroxymethyl cellulose

RL: NUU (Other use, unclassified); USES (Uses)

(thickener, for coating of **battery** electrodes; coating of substrates with active material, binder, and thickener for fabrication of **battery** electrodes)

L5 ANSWER 2 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2004:417091 CAPLUS

DOCUMENT NUMBER: 141:26073

TITLE: Synthesis of olivine-type  $\text{LiFePO}_4$  by emulsion-drying method

AUTHOR(S): Cho, Tae-Hyung; Chung, Hoon-Taek

CORPORATE SOURCE: Department of Ceramic Engineering, Dongshin University, Chonnam, Naju, 520-714, S. Korea

SOURCE: Journal of Power Sources (2004), 133(2), 272-276

CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 12 THERE ARE 12 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB Olivine-type, orthorhombic,  $\text{LiFePO}_4$  powders with small **particle size** were successfully synthesized by the emulsion-drying method. The electronic and crystal structure was analyzed by x-ray absorption spectroscopy and x-ray diffraction Rietveld refinement. The powder calcined at  $750^\circ$  showed the highest discharge capacity of 125 mA-h/g with excellent cycle stability. The discharge capacity of this powder increased to 154 mA-h/g on increasing the addition of carbon black as a conductive agent up to 40 weight%. In a rate capability test, the

discharge capacity was completely recovered and retained up to the 700th cycle.

ST iron lithium phosphate olivine type synthesis emulsion drying; cathode iron lithium phosphate **battery**

IT **Battery** cathodes  
(synthesis of olivine-type iron lithium phosphate by emulsion-drying method for use as cathode of lithium batteries)

IT **15365-14-7P**, Iron lithium phosphate (FeLiPO<sub>4</sub>)  
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); SPN (Synthetic preparation); PREP (Preparation); PROC (Process)  
(synthesis of olivine-type iron lithium phosphate by emulsion-drying method for use as cathode of lithium batteries)

L5 ANSWER 3 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2004:400252 CAPLUS

DOCUMENT NUMBER: 140:360128

TITLE: LiFePO<sub>4</sub> cathode materials for lithium-ion batteries

AUTHOR(S): Lue, Zhengzhong; Zhou, Zhentao

CORPORATE SOURCE: College of Material Science and Engineering, South China University of Technology, Guangzhou, 510641, Peop. Rep. China

SOURCE: Huaxue Tongbao (2004), 67(4), w025/1-w025/6

CODEN: HHTPAU; ISSN: 0441-3776

PUBLISHER: Huaxue Tongbao Bianjibu

DOCUMENT TYPE: Journal; General Review

LANGUAGE: Chinese

AB A review of the preparation, modification, control of crystal size, relation between structure and performance, and prospects for olivine-type LiFePO<sub>4</sub> cathode materials for Li-ion batteries. **Particle size** and its distribution, ionic and electronic conductivity, and the content of Fe(III), all influence performance. Inert gas, the addition of conductive dopants, and the control of crystal size to obtain nanosized powder, are used to improve the electrochem. performance of LiFePO<sub>4</sub>.

ST review iron lithium phosphate cathode lithium **battery**

IT **Battery** cathodes  
(LiFePO<sub>4</sub> cathode materials for lithium-ion batteries)

IT **15365-14-7**, Iron lithium phosphate (FeLiPO<sub>4</sub>)

RL: DEV (Device component use); USES (Uses)

(LiFePO<sub>4</sub> cathode materials for lithium-ion batteries)

L5 ANSWER 4 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2004:387966 CAPLUS

DOCUMENT NUMBER: 141:91722

TITLE: The effect of Cr doping on Li ion diffusion in LiFePO<sub>4</sub> from first principles investigations and Monte Carlo simulations

AUTHOR(S): Ouyang, C. Y.; Shi, S. Q.; Wang, Z. X.; Li, H.; Huang, X. J.; Chen, L. Q.

CORPORATE SOURCE: Laboratory for Solid State Ionics, Institute of Physics, Chinese Academy of Science, Beijing, 100080, Peop. Rep. China

SOURCE: Journal of Physics: Condensed Matter (2004), 16(13), 2265-2272

CODEN: JCOMEL; ISSN: 0953-8984

PUBLISHER: Institute of Physics Publishing

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB Using the adiabatic trajectory method, the migration energy barriers for the migration of Li ions and Cr ions along the 1-dimensional diffusion pathway in pure and Cr doped LiFePO<sub>4</sub> are obtained from 1st principles calcns. While Li ions can diffuse along the diffusion pathway easily, Cr ions do not easily diffuse away from their initial positions. This means

that the heavy Cr ions will block the 1-dimensional diffusion pathway of the material. Monte Carlo simulations are performed to evaluate the influences of the blocking behaviors on the electrochem. performance of LiFePO<sub>4</sub> cathode material for Li ion secondary batteries. The evaluated capacity is highly sensitive to the amount of the dopant, the size of the super-cell being used for simulation (**particle size** of the powder cathode material) and the Monte Carlo steps for statistics (charge-discharge c.d.).

ST chromium doping Lithium ion diffusion **battery** Monte Carlo simulation; cathode secondary lithium **battery** diffusion chromium iron lithium phosphate

IT **Battery** cathodes  
(materials for; effect of Cr doping on Li ion diffusion in LiFePO<sub>4</sub> from first principles investigations and Monte Carlo simulations)

IT **Particle size**  
(of powder, effects on predicted diffusion; effect of Cr doping on Li ion diffusion in LiFePO<sub>4</sub> from first principles investigations and Monte Carlo simulations)

IT Electric energy  
(simulated **battery** capacity; effect of Cr doping on Li ion diffusion in LiFePO<sub>4</sub> from first principles investigations and Monte Carlo simulations)

IT **15365-14-7**, Iron lithium phosphate (FeLiPO<sub>4</sub>)  
RL: PRP (Properties)  
(predicted and measured parameters; effect of Cr doping on Li ion diffusion in LiFePO<sub>4</sub> from first principles investigations and Monte Carlo simulations)

IT **672915-92-3**, Chromium iron lithium phosphate (Cr<sub>0.03</sub>FeLi<sub>0.91</sub>(PO<sub>4</sub>))  
RL: PRP (Properties)  
(predicted parameters; effect of Cr doping on Li ion diffusion in LiFePO<sub>4</sub> from first principles investigations and Monte Carlo simulations)

L5 ANSWER 5 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2004:338912 CAPLUS

DOCUMENT NUMBER: 140:409531

TITLE: Cycling performance of LiFePO<sub>4</sub> cathode material for lithium secondary batteries

AUTHOR(S): Kim, Hyung-Sun; Cho, Byung-Won; Cho, Won-Il

CORPORATE SOURCE: Eco-Nano Research Center, Korea Institute of Science and Technology (KIST), Seoul, 130-650, S. Korea

SOURCE: Journal of Power Sources (2004), 132(1-2), 235-239

CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB Lithium iron phosphate (LiFePO<sub>4</sub>) cathode material has been synthesized by a solid-state reaction which uses Li<sub>3</sub>PO<sub>4</sub> and Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>·8H<sub>2</sub>O as starting materials. These materials were mixed with alumina balls and treated thermally at various temps. in an argon and hydrogen atmospheric The crystalline intensity of LiFePO<sub>4</sub> powder prepared at 700° is higher than that of powders prepared at 600 and 800°. The **particle size** increases as the heat-treatment temperature increases. The material prepared at 700° gives a higher discharge capacity than the other materials, namely, 100 mA-h/g at the C/5 rate, which corresponds to 0.25 mA/cm<sup>2</sup>, and at room temperature Although the capacity increases as the operating temperature is increased, the degree of capacity fade also increases.

ST iron lithium phosphate cathode **battery**

IT **Battery** cathodes  
Secondary batteries  
(cycling performance of iron lithium phosphate cathode material for lithium secondary batteries)

IT 15365-14-7, Iron lithium phosphate (FeLiPO4)  
 RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)  
 (cycling performance of iron lithium phosphate cathode material for lithium secondary batteries)

L5 ANSWER 6 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
 ACCESSION NUMBER: 2004:335161 CAPLUS  
 DOCUMENT NUMBER: 141:108762  
 TITLE: Research progress in cathode material LiFePO4 of Li-ion **battery**  
 AUTHOR(S): Ren, Jun-xia; Yan, Jie; Wang, Xiao-jian; Gao, Xue-ping  
 CORPORATE SOURCE: Institute of New Energy Material Chemistry, Nankai University, Tianjin, 300071, Peop. Rep. China  
 SOURCE: Dianchi (2004), 34(1), 53-55  
 CODEN: DNCHEP; ISSN: 1001-1579  
 PUBLISHER: Dianchi Zazhishe  
 DOCUMENT TYPE: Journal  
 LANGUAGE: Chinese

TI Research progress in cathode material LiFePO4 of Li-ion **battery**  
 AB Lithium iron phosphate (LiFePO4) is a cathode material of Li-ion **battery**. Its synthesis methods, solid-reaction at high temperature and hydrothermal method, are described. The crystal structure, charge and discharge performance and cycling behavior are presented also. The effect of the conductive material, carbon black, on the conductivity, the **particle size** of LiFePO4, and doping effects are discussed.

ST lithium iron phosphate cathode lithium ion **battery**  
 IT Secondary batteries  
 (lithium ion; synthesis and properties of lithium iron phosphate as cathode material for lithium-ion **battery**)

IT **Battery** cathodes  
 (synthesis and properties of lithium iron phosphate as cathode material for lithium-ion **battery**)

IT 15365-14-7P, Iron lithium phosphate (LiFePO4)  
 RL: DEV (Device component use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)  
 (synthesis and properties of lithium iron phosphate as cathode material for lithium-ion **battery**)

L5 ANSWER 7 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
 ACCESSION NUMBER: 2004:159953 CAPLUS  
 DOCUMENT NUMBER: 140:202411  
 TITLE: Nonaqueous-electrolyte **battery** with cathode containing plural active mass particles  
 INVENTOR(S): Suzuki, Kiyohiko; Nirasawa, Takao; Komaru, Atsuo  
 PATENT ASSIGNEE(S): Sony Corp., Japan  
 SOURCE: Jpn. Kokai Tokyo Koho, 17 pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC: NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2004063269	A2	20040226	JP 2002-220055	20020729
PRIORITY APPLN. INFO.:			JP 2002-220055	20020729
TI	Nonaqueous-electrolyte <b>battery</b> with cathode containing plural active mass particles			
AB	The claimed <b>battery</b> is equipped with a cathode layer containing a first active mass (P1) and a second active mass (P2) having larger <b>particle size</b> than P1 formed on a current collector; where weight of P1 and P2, A and B, resp., satisfies A/B 0.05-1.5;			

particle size of P1 and P2, a and b, resp., satisfies  $a/b \leq 0.75$ ; and P1 satisfies  $T_g$  (98%)  $> 230^\circ$  [ $T_g$  (98%) is temperature showing 98% weight when heating P1 from  $100^\circ$ ]. The battery provides high capacity and high-temperature storage stability.

ST nonaq battery cathode particle size high  
temp storage stability

IT Secondary batteries  
(lithium; nonaq.-electrolyte battery with cathode containing plural active mass particles)

IT Battery cathodes  
Particle size  
(nonaq.-electrolyte battery with cathode containing plural active mass particles)

IT 180997-13-1, Lithium nickel oxide ( $\text{Li}_{1.05}\text{NiO}_2$ ) 663602-74-2, Iron lithium phosphate ( $\text{FeLi}_{1.05}(\text{PO}_4)$ )

RL: DEV (Device component use); USES (Uses)  
(cathode; nonaq.-electrolyte battery with cathode containing plural active mass particles)

L5 ANSWER 8 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2004:44658 CAPLUS

DOCUMENT NUMBER: 140:342010

TITLE: A new synthetic method for preparing  $\text{LiFePO}_4$  with enhanced electrochemical performance

AUTHOR(S): Guo, Z. P.; Liu, H.; Bewlay, S.; Liu, H. K.; Dou, S. X.

CORPORATE SOURCE: Institute for Superconducting & Electronic Materials, University of Wollongong, NSW, 2522, Australia

SOURCE: Journal of New Materials for Electrochemical Systems (2003), 6(4), 259-262

CODEN: JMESFQ; ISSN: 1480-2422

PUBLISHER: Journal of New Materials for Electrochemical Systems

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB The synthesis and properties of  $\text{LiFePO}_4$  cathode material, prepared by a modified solid-state reaction, is described. The novel aspect of the synthesis is the addition of a growth inhibitor (citric acid) to the precursor. The citric acid does not affect the structure of the cathode but improves its electrochem. performance because a powder with a small particle size is obtained. A cell discharged at 17 mA/g was had a sp. capacity of 167 mA-h/g with good capacity retention. EIS expts. verified that charge transfer was improved compared to a sample prepared by the conventional solid-state reaction.

ST iron lithium phosphate cathode synthesis citric acid lithium battery

IT Battery cathodes  
(in synthetic method for preparation of  $\text{LiFePO}_4$  cathode material for lithium batteries)

IT 15365-14-7P, Iron lithium phosphate ( $\text{FeLiPO}_4$ )

RL: DEV (Device component use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(synthetic method for preparation of  $\text{LiFePO}_4$  cathode material for lithium batteries)

L5 ANSWER 9 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2003:809272 CAPLUS

DOCUMENT NUMBER: 139:294697

TITLE: Composites of lithium iron phosphate and carbonaceous materials, their manufacture, their cathode active materials, and secondary lithium batteries employing same

INVENTOR(S): Negishi, Katsuyuki; Yamazaki, Nobuyuki



PATENT ASSIGNEE(S): Nippon Chemical Industrial Co., Ltd., Japan  
 SOURCE: Jpn. Kokai Tokkyo Koho, 15 pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003292309	A2	20031015	JP 2002-379445	20021227
PRIORITY APPLN. INFO.:			JP 2002-23985	A 20020131
			JP 2002-23996	A 20020131

AB The composites, showing average **particle size**  $\leq 0.5$   $\mu\text{m}$ , are manufactured by (a) preparation of precursors with sp. volume  $\leq 1.5$  mL/g containing  $\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$ ,  $\text{Li}_3\text{PO}_4$ , and carbonaceous material precursors and (b) firing the precursors for forming carbonaceous material-coated  $\text{LiFePO}_4$  particles. The secondary batteries show high discharge capacity.

ST carbonaceous coating lithium iron phosphate cathode **battery**;  
 polyethylene glycol carbonaceous lithium iron phosphate **battery**

IT **Battery** cathodes  
 (secondary; manufacture of composites of lithium iron phosphate and carbonaceous materials for cathode active materials of secondary lithium batteries)

IT **15365-14-7P**, Iron lithium phosphate ( $\text{LiFePO}_4$ )  
 RL: DEV (Device component use); IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); PYP (Physical process); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)  
 (carbonaceous material-coated, cathode active material; manufacture of composites of lithium iron phosphate and carbonaceous materials for cathode active materials of secondary lithium batteries)

L5 ANSWER 10 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2003:809271 CAPLUS

DOCUMENT NUMBER: 139:294696

TITLE: Composites of lithium iron phosphate and carbon, their manufacture, their cathode active materials, and secondary lithium batteries employing same

INVENTOR(S): Kinoshita, Masayuki; Nakaoka, Yasuhiro; Yamazaki, Nobuyuki

PATENT ASSIGNEE(S): Nippon Chemical Industrial Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 14 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003292308	A2	20031015	JP 2002-379434	20021227
PRIORITY APPLN. INFO.:			JP 2002-23961	A 20020131
			JP 2002-23980	A 20020131

AB The composites, showing average **particle size**  $\leq 0.5$   $\mu\text{m}$ , are manufactured by (a) mixing  $\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$ ,  $\text{Li}_3\text{PO}_4$ , and electroconductive carbon materials, (b) dry-pulverizing the mixts. for forming precursors with sp. volume  $\leq 1.5$  mL/g, (c) firing the precursors for forming electroconductive carbon material-coated  $\text{LiFePO}_4$  particles, and (d) pulverizing the particles. The secondary batteries show high discharge capacity.

ST lithium iron phosphate conductive carbon composite cathode **battery**

IT **Battery** cathodes

(secondary; manufacture of composites of lithium iron phosphate and carbon

for cathode active materials of secondary lithium batteries)  
 IT 15365-14-7P, Iron lithium phosphate (LiFePO<sub>4</sub>)  
 RL: DEV (Device component use); IMF (Industrial manufacture); PEP  
 (Physical, engineering or chemical process); PYP (Physical process); TEM  
 (Technical or engineered material use); PREP (Preparation); PROC  
 (Process); USES (Uses)  
 (carbon black-coated, cathode active material; manufacture of composites of  
 lithium iron phosphate and carbon for cathode active materials of  
 secondary lithium batteries)

L5 ANSWER 11 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2003:809270 CAPLUS

DOCUMENT NUMBER: 139:310059

TITLE: Manufacture of fine ferrous phosphate hydrate crystals  
 and lithium iron phosphorous oxides for secondary  
 lithium **battery** cathode active materials

INVENTOR(S): Kinoshita, Masayuki; Nakaoka, Yasuhiro; Yamazaki,  
 Nobuyuki; Negishi, Katsuyuki

PATENT ASSIGNEE(S): Nippon Chemical Industrial Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 12 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003292307	A2	20031015	JP 2002-379425	20021227
CN 1435372	A	20030813	CN 2003-102094	20030129
PRIORITY APPLN. INFO.:			JP 2002-23934	A 20020131
			JP 2002-379425	A 20021227

TI Manufacture of fine ferrous phosphate hydrate crystals and lithium iron  
 phosphorous oxides for secondary lithium **battery** cathode active  
 materials

AB Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>·8H<sub>2</sub>O (I), having average **particle size** of  
 ≤5 μm, is manufactured by treatment of alkalis with aqueous solns. containing  
 ferrous salts and H<sub>3</sub>PO<sub>4</sub>. Lithium iron phosphorus oxides are manufactured by  
 firing (A) I, lithium phosphate (II), and conductive carbonaceous  
 materials or (B) I, II, conductive carbonaceous materials, and ≥1  
 metal compds. containing elements chosen from Mn, Co, Ni, and Al, in the  
 process I has high reactivity arising from particle fineness. Secondary  
 Li batteries employing the oxides show high discharge capacity.

ST lithium iron phosphorus oxide **battery** cathode; ferrous phosphate  
 hydrate fine crystal manuf

IT Carbon black, uses

RL: DEV (Device component use); USES (Uses)

(ECP, elec. conductive coatings on lithium iron phosphorus oxides,  
 cathode active materials; manufacture of fine ferrous phosphate hydrate  
 crystals and lithium iron phosphorous oxides for secondary lithium  
**battery** cathode active materials)

IT Electric conductors

(carbonaceous, coatings on lithium iron phosphorus-based oxides; manufacture  
 of fine ferrous phosphate hydrate crystals and lithium iron phosphorous  
 oxides for secondary lithium **battery** cathode active  
 materials)

IT Carbonaceous materials (technological products)

RL: DEV (Device component use); TEM (Technical or engineered material  
 use); USES (Uses)

(elec. conductive coatings on lithium iron phosphorus-based oxides;  
 manufacture of fine ferrous phosphate hydrate crystals and lithium iron  
 phosphorous oxides for secondary lithium **battery** cathode  
 active materials)

IT **Battery** cathodes

(secondary; manufacture of fine ferrous phosphate hydrate crystals and lithium iron phosphorous oxides for secondary lithium **battery** cathode active materials)

- IT 15365-14-7P, Iron lithium phosphate ( $\text{LiFePO}_4$ ) 485386-79-6P  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(manufacture of fine ferrous phosphate hydrate crystals and lithium iron phosphorous oxides for secondary lithium **battery** cathode active materials)
- IT 10028-23-6P, Ferrous phosphate octahydrate 14154-09-7P, Manganese phosphate [ $\text{Mn}_3(\text{PO}_4)_2$ ]  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(manufacture of fine ferrous phosphate hydrate crystals and lithium iron phosphorous oxides for secondary lithium **battery** cathode active materials)
- IT 610316-49-9P, Cobalt iron lithium phosphorus oxide 610316-50-2P, Iron lithium nickel phosphorus oxide 610316-51-3P, Aluminum iron lithium phosphorus oxide  
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(manufacture of fine ferrous phosphate hydrate crystals and lithium iron phosphorous oxides for secondary lithium **battery** cathode active materials)
- IT 7664-38-2, Phosphoric acid, reactions 7782-63-0, Ferrous sulfate heptahydrate 10377-52-3, Lithium phosphate  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(manufacture of fine ferrous phosphate hydrate crystals and lithium iron phosphorous oxides for secondary lithium **battery** cathode active materials)
- IT 1310-73-2, Sodium hydroxide, reactions  
RL: RGT (Reagent); RACT (Reactant or reagent)  
(manufacture of fine ferrous phosphate hydrate crystals and lithium iron phosphorous oxides for secondary lithium **battery** cathode active materials)

L5 ANSWER 12 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2003:761329 CAPLUS

DOCUMENT NUMBER: 139:397895

TITLE: Synthesis of  $\text{LiFePO}_4$  by co-precipitation and microwave heating

AUTHOR(S): Park, K. S.; Son, J. T.; Chung, H. T.; Kim, S. J.; Lee, C. H.; Kim, H. G.

CORPORATE SOURCE: Department of Materials Science and Engineering, KAIST, Daejeon, 305-701, S. Korea

SOURCE: Electrochemistry Communications (2003), 5(10), 839-842.  
CODEN: ECCMF9; ISSN: 1388-2481

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 14 THERE ARE 14 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB  $\text{LiFePO}_4$  is a potential candidate for the cathode material of the lithium secondary batteries. Co-precipitation method and microwave heating were used to

prepare  $\text{LiFePO}_4$ . The samples were characterized by x-ray diffraction, SEM, **particle size** anal., ICP composition anal., and electrochem.

methods. Olivine phase  $\text{LiFePO}_4$  was successfully synthesized in a few minutes. The sp. capacity, cycle property, and rate capability were impressive as compared with previously obtained data. The microwave heating method using activated carbon is a very simple and useful tool for control of the iron oxidation state (2+) without reductive gas flow.

ST iron lithium phosphate microwave heating; cathode iron lithium phosphate **battery**

IT **Battery** cathodes  
Microwave heating  
(synthesis of iron lithium phosphate by co-precipitation and microwave heating  
for use as cathode material of lithium batteries)  
IT **15365-14-7**, Iron lithium phosphate (FeLiPO<sub>4</sub>)  
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)  
(synthesis of iron lithium phosphate by co-precipitation and microwave heating  
for use as cathode material of lithium batteries)

L5 ANSWER 13 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
ACCESSION NUMBER: 2003:552272 CAPLUS  
DOCUMENT NUMBER: 139:232964  
TITLE: Emulsion drying preparation of LiFePO<sub>4</sub>/C composite and its enhanced high-rate performance at 50°C  
AUTHOR(S): Myung, Seung-Taek; Komaba, Shinichi; Takagai, Ryohei; Kumagai, Naoaki; Lee, Yun-Sung  
CORPORATE SOURCE: Department of Chemical Engineering, Faculty of Engineering, Iwate University, Iwate, 020-8551, Japan  
SOURCE: Chemistry Letters (2003), 32(7), 566-567  
CODEN: CMLTAG; ISSN: 0366-7022  
PUBLISHER: Chemical Society of Japan  
DOCUMENT TYPE: Journal  
LANGUAGE: English  
REFERENCE COUNT: 14

THERE ARE 14 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB LiFePO<sub>4</sub>/C composite was successfully synthesized by an emulsion drying method. As confirmed by X-ray diffraction and scanning transmission electron microscopic observation, the prepared **particle size** of LiFePO<sub>4</sub> was of about 300 nm and the powder was modified by conductive carbon. Consequentially, the existence of carbon increased the electronic conductivity of LiFePO<sub>4</sub>/C composite to ca. 10<sup>-4</sup> S cm<sup>-1</sup> at 25°C. Because of smaller **particle size** and enhanced conductivity, the composite showed higher capacity about 140 mA h g<sup>-1</sup> (20 mA g<sup>-1</sup>), excellent cyclability and superior rate capability at 50°C, i.e., over 90 mA h (g-phosphate)<sup>-1</sup> at a c.d. of 1000 mA g<sup>-1</sup>.

ST iron lithium phosphate emulsion drying prepn **battery** cathode material

IT **Battery** anodes  
(emulsion drying preparation of LiFePO<sub>4</sub>/C composite and its enhanced high-rate performance at 50°C)

IT **15365-14-7P**, Iron lithium phosphate (FeLiPO<sub>4</sub>)  
RL: DEV (Device component use); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(composite with C; emulsion drying preparation of LiFePO<sub>4</sub>/C composite and its enhanced high-rate performance at 50°C)

L5 ANSWER 14 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
ACCESSION NUMBER: 2003:516711 CAPLUS  
DOCUMENT NUMBER: 139:339969  
TITLE: Morphological investigation of sub-micron FePO<sub>4</sub> and LiFePO<sub>4</sub> particles for rechargeable lithium batteries  
AUTHOR(S): Scaccia, Silvera; Carewska, Maria; Wisniewski, Pawel; Prosini, Pier Paolo  
CORPORATE SOURCE: C.R. Casaccia, Hydrogen Project and Fuel Cells, IDROCOMB, ENEA, Rome, I-00060, Italy  
SOURCE: Materials Research Bulletin (2003), 38(7), 1155-1163  
CODEN: MRBUAC; ISSN: 0025-5408  
PUBLISHER: Elsevier Science Ltd.  
DOCUMENT TYPE: Journal  
LANGUAGE: English  
REFERENCE COUNT: 13

THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS

RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB Microstructural variations of amorphous FePO<sub>4</sub> and LiFePO<sub>4</sub> (the latter obtained by chemical lithiation of the former) as a result of the annealing temperature were studied by Thermogravimetric Anal. (TGA)/DTA, chemical anal., Brunauer-Emmet-Taylor (BET) and SEM techniques. Round-shaped amorphous FePO<sub>4</sub> particles 40-80 nm in size are obtained after heating (at 400°) amorphous FePO<sub>4</sub>·2H<sub>2</sub>O in air (previously prepared by a precipitation route). On further heating at 650°, in air, crystalline trigonal FePO<sub>4</sub> of crystallite size <200 nm is formed. Round-shaped amorphous LiFePO<sub>4</sub> particles 40-80 nm in size crystallize by heating at 550° in Ar + 5%H<sub>2</sub> for 3 h. After thermal treatment, LiFePO<sub>4</sub> particles are interconnected by necks, which resembled a sintering process. The **particle size** of LiFePO<sub>4</sub> increases with an increase of temperature up to 750°, but an abnormal growth is evident at annealing temps. >650°. DTA anal. showed two exothermic peaks at 547° and 768° for FePO<sub>4</sub> due to phase transitions, whereas for LiFePO<sub>4</sub> two exothermic effects at 496° and 567° are shown.

ST morphol FePO<sub>4</sub> LiFePO<sub>4</sub> particle secondary lithium **battery** amorphous transition; BET SEM nanoparticles annealing **crystn particle size** lithiation

IT Annealing  
Crystal morphology  
Crystallites  
Dehydration  
Lithiation  
Nanoparticles  
**Particle size**  
Phase transition  
(morphol. investigation of sub-micron FePO<sub>4</sub> and LiFePO<sub>4</sub> particles for rechargeable lithium batteries)

IT **15365-14-7P**, Iron lithium phosphate (FeLiPO<sub>4</sub>)  
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PRP (Properties); PUR (Purification or recovery); PYP (Physical process); SPN (Synthetic preparation); PREP (Preparation); PROC (Process)  
(morphol. investigation of sub-micron FePO<sub>4</sub> and LiFePO<sub>4</sub> particles for rechargeable lithium batteries)

L5 ANSWER 15 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
ACCESSION NUMBER: 2002:904470 CAPLUS  
DOCUMENT NUMBER: 137:372594  
TITLE: Lithium transition-metal phosphate powder for rechargeable batteries  
PATENT ASSIGNEE(S): N.V. Umicore S.A., Belg.; Centre National de la Recherche Scientifique  
SOURCE: Eur. Pat. Appl., 15 pp.  
CODEN: EPXXDW  
DOCUMENT TYPE: Patent  
LANGUAGE: English  
FAMILY ACC. NUM. COUNT: 1  
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
EP 1261050	A1	20021127	EP 2001-401374	20010523
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR				
WO 2002099913	A1	20021212	WO 2002-EP5714	20020522
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM				

RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AT, BE, CH,  
CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR,  
BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG  
EP 1396038 A1 20040310 EP 2002-758202 20020522  
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT,  
IE, SI, LT, LV, FI, RO, MK, CY, AL, TR

PRIORITY APPLN. INFO.: EP 2001-401374 A 20010523  
WO 2002-EP5714 W 20020522

REFERENCE COUNT: 5 THERE ARE 5 CITED REFERENCES AVAILABLE FOR THIS  
RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB The invention concerns the manufacture and use of phosphates of transition  
metals as pos. electrodes for secondary lithium batteries and discloses a  
process for the production of  $\text{LiMPO}_4$  with controlled size and morphol., M  
being  $\text{FexCoyNizMnw}$ , with  $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ ,  
 $0 \leq z \leq 1$ ,  $0 \leq w \leq 1$  and  $x+y+z+w = 1$ . A  
process is disclosed for the manufacture of  $\text{LiFePO}_4$ , comprising the steps of  
providing an equimolar aqueous solution of  $\text{Li}^+$ ,  $\text{Fe}^{3+}$  and  $\text{PO}_4^{3-}$ , evaporating  
the water  
from the solution, thereby producing a solid mixture, decomposing the solid  
mixture  
at a temperature below  $500^\circ$  to form a pure homogeneous Li and Fe  
phosphate precursor, and annealing the precursor at a temperature of less than  
 $800^\circ$  in a reducing atmospheric, thereby forming a  $\text{LiFePO}_4$  powder. The  
obtained powders have a **particle size** of less than 1  
 $\mu\text{m}$ , and provide superior electrochem. performances once mixed for an  
appropriate time with elec. conductive powder.

ST **battery** cathode lithium transition metal phosphate powder

IT **Battery** cathodes

(lithium transition-metal phosphate powder for rechargeable batteries)

IT **15365-14-7P**, Iron lithium phosphate  $\text{FeLiPO}_4$  **475273-80-4P**

RL: DEV (Device component use); SPN (Synthetic preparation); PREP  
(Preparation); USES (Uses)

(lithium transition-metal phosphate powder for rechargeable batteries).

L5 ANSWER 16 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2002:505613 CAPLUS

DOCUMENT NUMBER: 137:355365

TITLE: Optimized  $\text{LiMnyFe}_{1-y}\text{PO}_4$  as the cathode for lithium  
batteries

AUTHOR(S): Li, Guohua; Azuma, Hideto; Tohda, Masayuki

CORPORATE SOURCE: Nishi Battery Laboratories, Sony Corporation, Atsugi,  
243-0021, Japan

SOURCE: Journal of the Electrochemical Society (2002), 149(6),  
A743-A747

CODEN: JESOAN; ISSN: 0013-4651

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 22 THERE ARE 22 CITED REFERENCES AVAILABLE FOR THIS  
RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB A new synthesis route has been developed for  $\text{LiMnyFe}_{1-y}\text{PO}_4$  ( $y = 0-0.9$ )  
powders. A significant improvement in electrode performance has been  
achieved by adding carbon black to the synthetic precursor. The  
carbon-containing  $\text{LiMnyFe}_{1-y}\text{PO}_4$  was synthesized under various conditions and  
the performance of the cathodes was evaluated using coin cells. The  
samples were characterized by X-ray diffraction, **particle-**  
**size** distribution measurements, scanning electron microscope  
observations, and BET surface area measurements. The addition of carbon  
black limited the **particle size** growth and enabled  
high electronic conductivity. Another advantage is simplification of electrode  
preparation, only needs the cathode powder to be mixed with binder. At large  
Mn content ( $y = 0.75$ ), a high capacity of 164 mAh/g has been achieved with  
an average discharge voltage of 3.63 V (595 Wh/kg) at room temperature. In  
addition,

LiMnyFe1-yPO4 demonstrated excellent storage performance at elevated temps. The thermal stability of the charged cathode was evaluated by thermogravimetric and differential scanning calorimetric thermal analyses.

ST lithium manganese iron phosphate carbon black **battery** cathode; rechargeable lithium **battery** cathode carbon lithium manganese iron phosphate

IT **Battery** cathodes  
(optimized high-manganese-content carbon black-containing lithium manganese iron phosphates as cathodes for rechargeable lithium batteries)

IT 15365-14-7, Iron lithium phosphate (FeLiPO4) 213467-46-0  
, Iron lithium manganese phosphate (FeLi2Mn(PO4)2) 300858-61-1  
371145-95-8 407629-83-8 407640-52-2, Iron  
lithium manganese phosphate (Fe0.1-1LiMn0-0.9(PO4)) 412351-36-1,  
Iron lithium manganese phosphate (Fe0.9LiMn0.1(PO4)) 464174-83-2  
464174-90-1 474902-99-3, Iron lithium manganese  
phosphate (Fe0.35LiMn0.65(PO4)) 474903-00-9, Iron lithium  
manganese phosphate (Fe0.3LiMn0.7(PO4)) 474903-03-2, Iron  
lithium manganese phosphate (Fe0.1LiMn0.9(PO4)) 474903-04-3  
RL: PRP (Properties); TEM (Technical or engineered material use); USES  
(Uses)  
(cathode; optimized high-manganese-content carbon black-containing lithium manganese iron phosphates as cathodes for rechargeable lithium batteries)

L5 ANSWER 17 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
ACCESSION NUMBER: 2002:292167 CAPLUS  
DOCUMENT NUMBER: 136:328121  
TITLE: Lithium-iron complex oxide for active mix of lithium secondary **battery** positive electrode  
INVENTOR(S): Kanzaki, Masao; Takeuchi, Youji; Ukyo, Yoshio  
PATENT ASSIGNEE(S): Toyota Central Research and Development Laboratories, Inc., Japan  
SOURCE: Jpn. Kokai Tokkyo Koho, 8 pp.  
CODEN: JKXXAF  
DOCUMENT TYPE: Patent  
LANGUAGE: Japanese  
FAMILY ACC. NUM. COUNT: 1  
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2002117845	A2	20020419	JP 2000-307685	20001006
PRIORITY APPLN. INFO.:			JP 2000-307685	20001006
TI	Lithium-iron complex oxide for active mix of lithium secondary <b>battery</b> positive electrode			
AB	Lithium-iron complex oxide for active mix of lithium secondary <b>battery</b> pos. electrode is LiFe1-xMxPO4 (M = Mn, Mg, Ni, Co; x = 0.02-0.2) with olivine crystal structure. The active mix preferably has a <b>particle size</b> of $\leq 1 \mu\text{m}$ . The <b>battery</b> has a large discharge capacity of active mix and good cycle life.			
ST	lithium iron complex oxide secondary <b>battery</b>			
IT	<b>Battery</b> cathodes (lithium-iron complex oxide for active mix of lithium secondary <b>battery</b> pos. electrode)			
IT	Olivine-group minerals RL: DEV (Device component use); USES (Uses) (lithium-iron complex oxide for active mix of lithium secondary <b>battery</b> pos. electrode)			
IT	412351-36-1, Iron lithium manganese phosphate (Fe0.9LiMn0.1(PO4)) RL: DEV (Device component use); USES (Uses) (lithium-iron complex oxide for active mix of lithium secondary <b>battery</b> pos. electrode)			

L5 ANSWER 18 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2002:256644 CAPLUS  
 DOCUMENT NUMBER: 136:297381  
 TITLE: Method for synthesis of carbon-coated redox materials with controlled size  
 INVENTOR(S): Armand, Michel; Gauhtier, Michel; Magnan, Jean-Francois; Ravet, Nathalie  
 PATENT ASSIGNEE(S): Hydro-Quebec, Can.  
 SOURCE: PCT Int. Appl., 83 pp.  
 CODEN: PIXXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: French  
 FAMILY ACC. NUM. COUNT: 2  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2002027823	A1	20020404	WO 2001-CA1349	20010921
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
AU 2001093568	A5	20020408	AU 2001-93568	20010921
EP 1325525	A1	20030709	EP 2001-973906	20010921
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR				
JP 2004509447	T2	20040325	JP 2002-531517	20010921
US 2004033360	A1	20040219	US 2003-362763	20030619
PRIORITY APPLN. INFO.:			CA 2000-2320661	A 20000926
			WO 2001-CA1349	W 20010921
REFERENCE COUNT:	2	THERE ARE 2 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT		
AB	Carbon-coated redox materials suitable for use as <b>battery</b> electrodes and for fabrication of electrochromic materials, consist of compns. of formulas C-LixM1-y (XO4)n or LixM1-yM'y (XO4)n, in which: y = 0-0.6; x = 0-2; n = 1-1.5; M is a transition metal or a mixture of first-row transition metals; M' is a fixed-valent metal ion selected from Mg2+, Ca2+, Al3+, or Zn2+; and X is S, P, and Si. The resulting materials consist of particles coated with a conductive carbon layer. The compns. are prepared by reacting a balanced mixture of precursors in the appropriate proportions, including a pyrolysis step for the carbon-producing compound(s), such that the materials form a powdered composition with the desired formula, that has an elec. conductivity of >10-8 S/cm when compacted at 3750 kg/cm2.			
ST	carbon encapsulated redox material <b>battery</b> electrode; electrochromic material carbon coated redox <b>particle size</b> ; cathode <b>battery</b> carbon coated redox material			
IT	Fluoropolymers, uses RL: NUU (Other use, unclassified); USES (Uses) (binder; synthesis of carbon-coated redox materials for use as <b>battery</b> cathodes and in electrochromic devices)			
IT	<b>Battery</b> cathodes <b>Battery</b> electrodes Electrochromic materials Redox agents (synthesis of carbon-coated redox materials for use as <b>battery</b> cathodes and in electrochromic devices)			
IT	24937-79-9, Poly(vinylidene difluoride) RL: NUU (Other use, unclassified); USES (Uses)			



(binder; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

IT 9004-35-7, Cellulose acetate 43094-71-9, Ethylene-ethylene oxide copolymer  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (carbon source; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

IT 7440-44-0, Carbon, uses  
 RL: DEV (Device component use); USES (Uses)  
 (coating, cathodes containing; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

IT 96-49-1, Ethylene carbonate 616-38-6, Dimethylcarbonate 7791-03-9, Lithium perchlorate 90076-65-6, Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt  
 RL: NUU (Other use, unclassified); USES (Uses)  
 (electrolyte containing; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

IT 554-13-2, Lithium carbonate  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (reaction of; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

IT 13463-10-0, Ferric phosphate dihydrate  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (reduction of; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

IT 7429-90-5P, Aluminum, uses 7439-95-4P, Magnesium, uses 7440-66-6P, Zinc, uses 7440-70-2P, Calcium, uses 13816-45-0P, Triphylite 15365-14-7P, Iron lithium phosphate ( $\text{FeLiPO}_4$ ) 213467-46-0P, Iron lithium manganese phosphate ( $\text{FeLi}_2\text{Mn}(\text{PO}_4)_2$ )  
 RL: DEV (Device component use); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)  
 (redox cathode containing; synthesis of carbon-coated redox materials for use as **battery** cathodes and in electrochromic devices)

L5 ANSWER 19 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2002:253126 CAPLUS

DOCUMENT NUMBER: 136:265826

TITLE: Method for the preparation of cathode active material for a nonaqueous electrolyte **battery**

INVENTOR(S): Hosoya, Mamoru; Takahashi, Kimio; Fukushima, Yuzuru

PATENT ASSIGNEE(S): Sony Corporation, Japan

SOURCE: Eur. Pat. Appl., 16 pp.

CODEN: EPXXDW

DOCUMENT TYPE: Patent

LANGUAGE: English

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
EP 1193784	A2	20020403	EP 2001-122752	20010921
EP 1193784	A3	20040310		
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO				
JP 2002110165	A2	20020412	JP 2000-301403	20000929
TW 535316	B	20030601	TW 2001-90123360	20010921
US 2002041998	A1	20020411	US 2001-961863	20010924
CN 1349264	A	20020515	CN 2001-142531	20010929
PRIORITY APPLN. INFO.:			JP 2000-301403	A 20000929

TI Method for the preparation of cathode active material for a nonaqueous electrolyte **battery**

AB A  $\text{LiFePO}_4$  carbon composite material is to be synthesized in a single phase satisfactorily to achieve superior cell characteristics. In preparing a cathode active material, a starting material for synthesis of a

compound represented by the general formula  $\text{Li}_x\text{FePO}_4$ , where  $0 < x \leq 1$ , is mixed, milled and sintered and a carbon material is added to the resulting mass at an optional time point in the course of mixing, milling and sintering.  $\text{Li}_3\text{PO}_4$ ,  $\text{Fe}_3(\text{PO}_4)_2$  or its hydrates  $\text{Fe}_3(\text{PO}_4)_2 \cdot n\text{H}_2\text{O}$ , where  $n$  denotes the number of hydrates, are used as the starting material for synthesis of  $\text{Li}_x\text{FePO}_4$ . The **particle size** distribution of particles of the starting material for synthesis following the milling with the **particle size** not less than  $3 \mu\text{m}$  is set to 2.2% or less in terms of the volumetric integration frequency.

- ST **battery** cathode lithium iron phosphate carbon composite  
 IT Secondary batteries  
     (lithium; method for preparation of cathode active material for nonaq. electrolyte **battery**)  
 IT **Battery** cathodes  
     **Particle size** distribution  
     (method for preparation of cathode active material for nonaq. electrolyte **battery**)  
 IT Carbon black, uses  
     RL: DEV (Device component use); MOA (Modifier or additive use); USES  
     (Uses)  
     (method for preparation of cathode active material for nonaq. electrolyte **battery**)  
 IT Ball milling  
     (planetary; method for preparation of cathode active material for nonaq. electrolyte **battery**)  
 IT 108-32-7, Propylene carbonate 616-38-6, Dimethyl carbonate 9011-17-0, Hexafluoropropylene-vinylidene fluoride copolymer 21324-40-3, Lithium hexafluorophosphate  
     RL: DEV (Device component use); USES (Uses)  
     (method for preparation of cathode active material for nonaq. electrolyte **battery**)  
 IT 7440-44-0, Carbon, uses  
     RL: DEV (Device component use); MOA (Modifier or additive use); USES  
     (Uses)  
     (method for preparation of cathode active material for nonaq. electrolyte **battery**)  
 IT 15365-14-7P, Iron lithium phosphate  $\text{FeLiPO}_4$  198782-39-7P  
     , Iron lithium phosphate ( $\text{FeLi}_{0-1}(\text{PO}_4)$ )  
     RL: DEV (Device component use); SPN (Synthetic preparation); PREP  
     (Preparation); USES (Uses)  
     (method for preparation of cathode active material for nonaq. electrolyte **battery**)

L5 ANSWER 20 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2002:196333 CAPLUS

DOCUMENT NUMBER: 136:404204

TITLE: A novel concept for the synthesis of an improved  $\text{LiFePO}_4$  lithium **battery** cathode

AUTHOR(S): Croce, F.; D'Epifanio, A.; Hassoun, J.; Deptula, A.; Olczac, T.; Scrosati, B.

CORPORATE SOURCE: Dipartimento di Chimica, Universita "La Sapienza", Rome, 00185, Italy

SOURCE: Electrochemical and Solid-State Letters (2002), 5(3), A47-A50

CODEN: ESLEF6; ISSN: 1099-0062

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

TI A novel concept for the synthesis of an improved  $\text{LiFePO}_4$  lithium **battery** cathode

AB This paper describes the synthesis and the properties of a kinetically

improved LiFePO<sub>4</sub> cathode material. The novel aspect of the synthesis is based on a critical step involving the dispersion of metal (e.g., copper or silver) at a very low concentration (1 wt%). This metal addition does not affect the structure of the cathode but considerably improves its kinetics in terms of capacity delivery and cycle life. Such an enhancement of the electrochem. properties has been ascribed to a reduction of the **particle size** and to an increase of the bulk intra- and interparticle electronic conductivity of LiFePO<sub>4</sub>, both effects being promoted by the finely dispersed metal powders. This improved conductivity favors the response of LiFePO<sub>4</sub>, thus substantiating its interest as new cathode for advanced lithium ion batteries.

ST synthesis lithium iron phosphate **battery** cathode copper silver powder

IT Electric charge  
(charge-discharge cycling of LiFePO<sub>4</sub> lithium **battery** cathode in EC/DEC containing LiClO<sub>4</sub>)

IT Secondary batteries  
(lithium; novel concept for synthesis of improved LiFePO<sub>4</sub> lithium **battery** cathode)

IT **Battery** cathodes  
Sol-gel processing  
Synthesis  
(novel concept for synthesis of improved LiFePO<sub>4</sub> lithium **battery** cathode)

IT **Particle size**  
(of improved LiFePO<sub>4</sub> lithium **battery** cathode formed by sol-gel processing)

IT Microstructure  
(of improved LiFePO<sub>4</sub> with added copper or silver powder lithium **battery** cathode)

IT 96-49-1, Ethylene carbonate 105-58-8, Diethyl carbonate 7791-03-9, Lithium perchlorate  
RL: NUU (Other use, unclassified); USES (Uses)  
(charge-discharge cycling of LiFePO<sub>4</sub> lithium **battery** cathode in EC/DEC containing LiClO<sub>4</sub>)

IT 7440-22-4, Silver, uses 7440-50-8, Copper, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(fine powder; use in synthesis of improved LiFePO<sub>4</sub> lithium **battery** cathode)

IT **15365-14-7P**, Iron lithium phosphate FeLiPO<sub>4</sub>  
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); PROC (Process); USES (Uses)  
(novel concept for synthesis of improved LiFePO<sub>4</sub> lithium **battery** cathode)

IT 50-81-7, Ascorbic acid, reactions 1310-65-2, Lithium hydroxide 7664-38-2, Phosphoric acid, reactions 10421-48-4  
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
(use in synthesis of improved LiFePO<sub>4</sub> lithium **battery** cathode)

L5 ANSWER 21 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2001:691570 CAPLUS

DOCUMENT NUMBER: 136:56310

TITLE: Approaching theoretical capacity of LiFePO<sub>4</sub> at room temperature at high rates

AUTHOR(S): Huang, H.; Yin, S.-C.; Nazar, L. F.

CORPORATE SOURCE: Department of Chemistry, University of Waterloo, Waterloo, ON, N2L G61, Can.

SOURCE: Electrochemical and Solid-State Letters (2001), 4(10), A170-A172

PUBLISHER: CODEN: ESLEF6; ISSN: 1099-0062  
DOCUMENT TYPE: Electrochemical Society  
LANGUAGE: Journal  
REFERENCE COUNT: English

19 THERE ARE 19 CITED REFERENCES AVAILABLE FOR THIS  
RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB Nanocomposites of  $\text{LiFePO}_4$  and conductive carbon were prepared by two different methods which lead to enhanced electrochem. accessibility of the Fe redox centers in this insulating material. Method A employs a composite of the phosphate with a carbon xerogel formed from a resorcinol-formaldehyde precursor; method B uses surface-oxidized carbon particles to act as a nucleating agent for phosphate growth. Both **particle size** minimization and intimate carbon contact are necessary to optimize electrochem. performance. Although both methods succeed for the first criteria, the latter is best achieved with method A, affording excellent characteristics in room temperature, liquid electrolyte cells.

The resultant  $\text{LiFePO}_4/\text{C}$  composite achieves 90% theor. capacity at C/2, with very good rate capability and excellent stability.

ST lithium iron phosphate cathode **battery**

IT **Battery** cathodes  
Microstructure

**Particle size**

Surface structure

(approaching theor. capacity of  $\text{LiFePO}_4$  at room temperature at high rates)

IT 7440-44-0, Carbon, uses **15365-14-7**, Iron lithium phosphate  
felipo4

RL: DEV (Device component use); USES (Uses)

(approaching theor. capacity of  $\text{LiFePO}_4$  at room temperature at high rates)

L5 ANSWER 22 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2001:498313 CAPLUS

DOCUMENT NUMBER: 135:139793

TITLE: Characterization of  $\text{LiFePO}_4$  as the cathode material  
for rechargeable lithium batteries

AUTHOR(S): Takahashi, M.; Tobishima, S.; Takei, K.; Sakurai, Y.

CORPORATE SOURCE: NTT Telecommunications Energy Laboratories,  
Ibaraki-ken, Naka-gun, Tokai-mura, 319-1193, Japan

SOURCE: Journal of Power Sources (2001), 97-98, 508-511

CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier Science S.A.

DOCUMENT TYPE: Journal

LANGUAGE: English

REFERENCE COUNT: 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS  
RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

AB We investigated the electrochem. characteristics of  $\text{LiFePO}_4$  when used as the cathode material for rechargeable lithium batteries. We also studied the change in the crystal structure of the material during discharge. The material prepared at a relatively low temperature of 675° showed a higher charge and discharge capacity than that prepared at higher temps. This was because material prepared at a low temperature has a relatively small **particle size** and a rough surface morphol. We also found that the crystal structure of electrochem. delithiated  $\text{LiFePO}_4$  was similar to a heterosite structure and the sample reverted to its original triphylite structure after electrochem. lithiation.

ST iron lithium phosphate cathode **battery**

IT **Battery** cathodes

(characterization of iron lithium phosphate as cathode material for rechargeable lithium batteries)

IT **15365-14-7**, Iron lithium phosphate ( $\text{FeLiPO}_4$ )

RL: DEV (Device component use); USES (Uses)

(characterization of iron lithium phosphate as cathode material for rechargeable lithium batteries)

L5 ANSWER 23 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
 ACCESSION NUMBER: 2001:222924 CAPLUS  
 DOCUMENT NUMBER: 134:329012  
 TITLE: Optimized LiFePO4 for lithium **battery**  
 cathodes  
 AUTHOR(S): Yamada, A.; Chung, S. C.; Hinokuma, K.  
 CORPORATE SOURCE: Frontier Science Laboratories, Sony Corporation,  
 Yokohama, 240-0036, Japan  
 SOURCE: Journal of the Electrochemical Society (2001), 148(3),  
 A224-A229  
 CODEN: JESOAN; ISSN: 0013-4651  
 PUBLISHER: Electrochemical Society  
 DOCUMENT TYPE: Journal  
 LANGUAGE: English  
 REFERENCE COUNT: 25 THERE ARE 25 CITED REFERENCES AVAILABLE FOR THIS  
 RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

TI Optimized LiFePO4 for lithium **battery** cathodes  
 AB LiFePO4 powders were synthesized under various conditions and the  
 performance of the cathodes was evaluated using coin cells. The samples  
 were characterized by X-ray diffraction, scanning electron microscope  
 observations, Brunauer, Emmett, and Teller surface area measurements,  
**particle-size** distribution measurements, and Mossbauer  
 spectroscopy. Ab initio calcn. was used to confirm the exptl. redox  
 potentials and Mossbauer parameters. The choice of a moderate sintering  
 temperature (500°C < T < 600°C) and a homogeneous precursor  
 enabled nearly perfect utilization of > 95% of the 170 mAh/g theor.  
 capacity at room temperature There are two main obstacles to achieving optimum  
 charge/discharge performance of LiFePO4: (i) undesirable particle growth  
 at T > 600°C and (ii) the presence of a noncryst. residual Fe3+  
 phase at T < 500°C.  
 ST lithium iron phosphate cathode **battery**  
 IT Secondary batteries  
 (lithium; optimized LiFePO4 for lithium **battery** cathodes)  
 IT **Battery** cathodes  
 Crystal structure  
 (optimized LiFePO4 for lithium **battery** cathodes)  
 IT 15365-14-7, Iron lithium phosphate felipo4  
 RL: DEV (Device component use); USES (Uses)  
 (optimized LiFePO4 for lithium **battery** cathodes)

L5 ANSWER 24 OF 24 CAPLUS COPYRIGHT 2004 ACS on STN  
 ACCESSION NUMBER: 2000:725897 CAPLUS  
 DOCUMENT NUMBER: 133:298812  
 TITLE: Manufacture of active material of positive electrode  
 for nonaqueous electrolyte **cell**  
 INVENTOR(S): Yamada, Atsuo; Li, Guohua; Azuma, Hideto  
 PATENT ASSIGNEE(S): Sony Corp., Japan  
 SOURCE: PCT Int. Appl., 65 pp.  
 CODEN: PIXXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2000060680	A1	20001012	WO 2000-JP1916	20000328
W: CA, CN, JP, KR, US				
RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
CA 2334003	AA	20001012	CA 2000-2334003	20000328
EP 1094533	A1	20010425	EP 2000-911429	20000328
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, FI				

TW 447162	B	20010721	TW 2000-89106240	20000405
US 6632566	B1	20031014	US 2001-701903	20010214
US 2004002003	A1	20040101	US 2003-611622	20030630
PRIORITY APPLN. INFO.:			JP 1999-99408	A 19990406
			JP 1999-274380	A 19990928
			JP 2000-14131	A 20000119
			WO 2000-JP1916	W 20000328
			US 2001-701903	A3 20010214

REFERENCE COUNT: 6 THERE ARE 6 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

- TI Manufacture of active material of positive electrode for nonaqueous electrolyte **cell**
- AB The active material of a pos. electrode comprises particles made of a compound having a general formula  $\text{Li}_x\text{MyPO}_4$  where  $0 < x \leq 2$ ,  $0.8 \leq y \leq 1.2$ , and M is an element selected from the 3d-transition metals and the **particle size** is  $\leq 10 \mu\text{m}$ . The active material can be used for an nonaq. electrolyte secondary **cell**, and contributes to achieving an excellent cycle characteristic and a high capacity.
- ST nonaq electrolyte **cell** pos electrode manuf; electrode active material lithium metal phosphate
- IT **Battery** electrodes  
(nonaq. electrolyte; manufacture of active material of pos. electrode for nonaq. electrolyte **cell**)
- IT 554-13-2, Lithium carbonate 598-62-9, Manganese carbonate  $\text{MnCO}_3$   
3094-87-9, Ferrous acetate 7722-76-1, Ammonium dihydrogen phosphate  
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT (Reactant or reagent); USES (Uses)  
(in manufacture of active material of pos. electrode for nonaq. electrolyte **cell**)
- IT 15365-14-7P, Iron lithium phosphate  $\text{FeLiPO}_4$  300858-61-1P  
, Iron lithium manganese phosphate ( $\text{Fe}_{0.4}\text{LiMn}_{0.6}(\text{PO}_4)$ )  
RL: IMF (Industrial manufacture); PREP (Preparation)  
(manufacture of active material of pos. electrode for nonaq. electrolyte